

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : B30B 15/06, D03D 15/08		A1	(11) International Publication Number: WO 96/13376
			(43) International Publication Date: 9 May 1996 (09.05.96)
(21) International Application Number: PCT/GB95/02421 (22) International Filing Date: 13 October 1995 (13.10.95) (30) Priority Data: 9421573.8 26 October 1994 (26.10.94) GB (71) Applicant (for all designated States except US): MARATHON BELTING LIMITED [GB/GB]; Healey Mill, Whitworth Road, Rochdale OL12 0TF (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): DOUGLAS, Melvyn [GB/GB]; Healey Mill, Whitworth Road, Rochdale OL12 0TF (GB). BOYES, Peter [GB/GB]; Healey Mill, Whitworth Road, Rochdale OL12 0TF (GB). PAYNE, John, Lynn [GB/GB]; Healey Mill, Whitworth Road, Rochdale OL12 0TF (GB). (74) Agent: BRAY, Lilian, Janet; L.J. Bray & Co., Raw Holme, Midgehole Road, Hebden Bridge, West Yorkshire HX7 7AF (GB).		(81) Designated States: JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.	
(54) Title: A PRESS PAD (57) Abstract <p>A press pad for use in a laminating press comprises a woven fabric of heat resistant strands. A substantial proportion of either the warp (B) or the weft (A) comprises a silicone elastomer. Preferably, the silicone elastomer has a specific gravity within the range of 1.1 g/cm³ to 1.4 g/cm³ inclusive but advantageously, the silicone elastomer has a specific gravity of 1.20 ± 0.02 g/cm³. In preferred embodiments the weft (A) comprises silicone covered copper wire whilst the warp (B) comprises at least one of stainless steel wires, copper wires, copper alloy wires, copper wires wrapped with an aromatic polyamide yarn, stainless steel wires wrapped with an aromatic polyamide yarn, aromatic polyamide yarn, and polyester yarn.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> </div> <div style="text-align: center;"> </div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 20px;"> <div style="text-align: center;"> <p>10, 11, 12, 13, 14, 15, 16, 17,</p> </div> <div style="text-align: center;"> </div> </div>			

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

A PRESS PAD

5 The present invention relates to a press pad for use in a laminating press for the production of laminate sheets, such as decorative laminates and printed circuit boards, using low pressure and high pressure single daylight and multi daylight presses.

10 As shown in Fig. 4 of the drawings appended hereto, in a single daylight laminating press, a laminate sheet 1 to be pressed between two platens 2 of the press is located between two metal caul plates 3 and two press pads 4. The press pads 4 are each located between one of the caul plates 3 and one of the platens 2. The press pads 4 are
15 usually a little larger than the dimensions of the platen 2 to allow for clamping.

The purpose of the press pads 4 is to compensate for density variations in the laminate sheet 1 and thereby
20 ensure that an equal pressure is applied to all parts of the sheet 1. In addition, the press pads 4 compensate for any unevenness in the surfaces of the platens 2 of the press itself and any flexure or bowing of the platens 2 when under pressure. Again, this assists in the production
25 of a flat even density laminate. Thus, it is important for a press pad to be resilient and have a natural springiness to permit it to compensate for the aforementioned density variations and the surface unevenness of the press platens but also to allow it to relax after each pressing operation
30 and recover its form to enable it to be used again. The capacity a press pad has to re-form itself after each pressing is an important characteristic to ensure a reasonable working life and to avoid unnecessary downtime of a press whilst the press pads are replaced.

35

However, because the purpose of the press is to apply

heat to the laminate sheet whilst it is under pressure, it is important that the press pad also conducts the heat supplied by the press platens to the laminate sheet. Working temperatures for such presses are usually in a
5 range up to 220°C.

Typically, therefore, a conventional press pad is a densely woven combination of high temperature resistant non-asbestos yarns and metal wire. The metal wire is
10 included to give good heat transmission through the pad to the laminate sheet. In contrast, the non-metal yarn is required to give the pad the springiness and resilience required to enable the pad to relax after each pressing operation. The relative proportion of the two types of
15 material is a consideration when devising a press pad for a particular purpose. Usually a compromise must be reached between the heat transference and the resilience required in each case.

20 The metal wires used are typically copper or brass wire whereas the temperature resistant yarns are usually made from aromatic polyamide fibres such as those manufactured and marketed by Du Pont Inc under the trade marks KEVLAR and NOMEX. Whilst metal wires can be woven per
25 se, it is also common for metal strands to be wrapped around heat resistant yarns and for heat resistant yarns to be wrapped around metal strands. Metal wires may also be sheathed with textile fibres.

30 A conventional press pad for use in a high pressure daylight press is described in EP 0 493 630 A1. Here, the press pad is made from a woven textile of aromatic polyamide and metal threads.

35 Another press pad is described in EP 0 488 071 A2. This also is made from a combination of heat resistant

organic fibres, such as aramide fibres, phenol fibres, polyetheretherketone fibres, and polyphenylsulfone fibres, and heat resistant inorganic fibres such as carbon fibres, glass fibres and metallic fibres.

5

One of the problems encountered with these conventional press pads is that in use, the metal threads eventually flatten the weave structure to such an extent that the press pad is unable to relax after each pressing operation and the pad loses its resilience and springiness.

10

Another problem with conventional press pads is that once a pad has been used for pressing a particular size and format of laminate sheet, it is generally not possible to use the pad again with sheets of a larger size or different format without leaving marks on the subsequently pressed sheets.

15

It is an object of the invention to provide a press pad which has a greater resilience and springiness over conventional pads and for a longer period without compromising the heat conduction capability of the pad. In addition, it is an object of the present invention to provide a press pad which mitigates the effect of format changes in the laminate sheets being pressed.

20

25

According to the present invention there is provided a press pad for use in a laminate press comprising a woven fabric of heat resistant strands, characterised in that a substantial proportion of at least one of the warp and the weft comprises a silicone elastomer.

30

The advantage of using a silicone elastomer in a press pad is that it provides a high degree of springiness and resistance to compressive loads whilst not impeding heat

35

transference through the press pad to any greater extent than conventional materials such as aromatic polyamides. In addition, because the silicone is in itself a springy, resilient material, the springiness and resilience of the press pad is not solely dependent on its weave structure. Thus, a press pad according to the invention can be used for a longer period than a similarly woven conventional pad before losing its compensating ability. In addition, format changes in the laminate sheets being pressed can be more readily accommodated.

In addition, it is also anticipated that unlike some conventional press pads, if the silicone in the press pad is cut by metal wires which are also present in the pad, the springiness of the pad will not be significantly affected.

The silicone elastomer preferably has a specific gravity within the range of 1.1 g/cm³ to 1.4 g/cm³ inclusive. More particularly, however, the silicone elastomer advantageously has a specific gravity of 1.20 ± 0.02 g/cm³. Silicone elastomers within this latter range exhibit the best qualities for this application, combining the properties of a long working life, high tear strength and a good resilience to compression.

Preferably, at least one of the warp and the weft comprises silicone covered metal wire. Alternatively, at least one of the warp and the weft comprises substantially solid silicone strands.

Preferably also, the wall thickness of the silicone of the silicone covered wire is at least 0.2 mm, and the overall outside diameter of the silicone covered wire is at least 1.0 mm.

Preferably also, the wire comprises a stranded or braided copper wire wherein the diameter of each wire strand is at least 0.05 mm.

5 Preferably also, the wire comprises a stranded wire made up from at least 7 wire strands.

10 Preferably also, the other of the warp and the weft from that which comprises the silicone elastomer, comprises strands of a copper alloy.

The present invention will now be described by way of example with reference to the accompanying drawings, in which:-

15

Figs. 1a to 3a are cross-sections of three examples of weaves for use in the manufacture of press pads according to the invention;

20

Figs. 1b to 3b are weave pattern diagrams for the weaves shown in Figs. 1a to 3a respectively; and

25

Fig. 4 is a diagram showing the conventional arrangement of a laminate sheet and press pads in a single daylight press.

30

A press pad for use in a laminate press comprises a densely woven fabric which is made of materials that are heat resistant to at least 220°C. A substantial proportion of at least either the weft or the warp or both are strands comprising a silicone elastomer. The rest of the warp and weft not made of this material is made substantially of metal, either in the form of wire, which can be stranded or otherwise, or as a wrapping for a heat resistant yarn such as an aromatic polyamide yarn.

35

Preferably, the weft comprises a silicone covered wire, such as copper wire. For example, a suitable silicone covered wire may be a silicone covered nickel plated copper wire. However, it is also envisaged that the weft could
5 comprise solid silicone strands.

The type of silicone elastomer used is important in order to secure the best properties for the performance of the press pad made therefrom. Silicone elastomers with a
10 specific gravity within the range of 1.1 g/cm³ to 1.4 g/cm³ inclusive can be used but in order to secure the best properties wherein it is neither sufficiently springy under compression nor too brittle, the silicone elastomer preferably has a specific gravity of 1.20 ± 0.02 g/cm³ with
15 a hardness of 70 ± 5 IRHD. In addition it is preferably a high tear strength elastomer, for example with a minimum tear strength of 15 kN per metre and a minimum tensile strength of 6MPa. Such a silicone elastomer is cut-resistant and capable of operating continuously at working
20 temperatures of up to 220°C. In addition, it is capable of withstanding and recovering from pressures in the range 20 kg per cm² to 120 kg per cm² for a pressing time in the range of 15 seconds to 120 minutes as can be found in laminate presses of various types.

25 If silicone covered wire is used in the weft, the wall thickness of the silicone is preferably at least 0.2 mm and the overall outside diameter of the silicone covered wire is at least 1.0 mm. Stranded or braided wire can also be
30 used wherein the wire preferably comprises at least 7 wire strands.

Such silicone covered wire can be made in a conventional manner, preferably by being extruded over
35 either a solid metal wire or a stranded metal wire. In addition, if silicone covered copper wire is used, the

copper wire can be plated to prevent oxidisation of the copper. For example, as indicated above a suitable silicone covered wire may be a silicone covered nickel plated copper wire such as is commonly used for electrical wiring.

5 Alternatively, for the reason mentioned below, the wire may comprise stainless steel wire to overcome any problems associated with metal fatigue.

However, these problems may also be overcome by using

10 multi-stranded copper wire which exhibits a high reversed bending strength and therefore has a lower susceptibility to metal fatigue and a greater flexibility than the conventional copper wire used for electrical wiring. Here, for example, up to 102 strands of copper wire, each of at

15 least 0.05 mm can be covered with silicone as previously described to produce a wire of similar exterior dimensions to those previously described. Alternatively, for example, a silicone covered multi-stranded copper wire with up to 66 strands of copper wire, each of at least 0.07 could be

20 used.

With regard to the warp strands of the pad, soft annealed copper wire is conventionally used in press pads because it is ductile and easily made into strands suitable

25 for weaving, and it is a good heat conductor. Other metals such as aluminium, and alloys such as brass, may also be used. Whilst such metal strands can also be used in a press pad according to the present invention, it has been found that in view of the high degree of compensation present in

30 the press pad, wherein the metal strands in the pad are repeatedly flattened out during pressing and sprung back to regain their former position by the natural springiness of the silicone elastomer after each pressing operation, the metal strands can in time exhibit the symptoms of metal

35 fatigue. Soft annealed copper is susceptible in this regard. Hence, it is envisaged that, dependent on the

particular application of the press pad, other metals which exhibit a better resistance to metal fatigue may be used either wholly or in part to form the warp strands of the pad. For example, stainless steel strands or copper alloys
5 may be used, in particular alloys of copper with a heavy metal such as cadmium and zirconium, or with iron.

Such copper alloys wherein the proportion of the second metal is small in comparison to the whole, for
10 example copper cadmium alloys wherein the proportion of cadmium is approximately 1 % of the whole, exhibit a higher reversed bending strength than soft annealed copper without significantly compromising the heat conductive properties of the metal and therefore the pad. The compensation
15 ability of the pad is therefore ameliorated by the additional springiness of the copper alloy when compared with the relative malleability of soft annealed copper.

Non-metal strands, such as aromatic polyamide yarns or
20 polyester yarns, may also be used to form the warp strands. In addition, metal strands such as copper or stainless steel strands may be wrapped with an aromatic polyamide yarn in a conventional manner.

25 Stainless steel strands may also be used to braid the exterior of silicone covered copper wire which may be used in the weft to improve its resistance to metal fatigue. Such braided strands could also be used in the warp of the
weave.

30 It will be appreciated that although the types of strands used in the warp and in the weft have been differentiated as described above, it is possible for the warp to comprise substantially the silicone elastomer and
35 the weft to comprise substantially metal strands or other heat resistant yarns.

Three examples of weaves suitable for use in the manufacture of a press pad will now be described with reference to the drawings. However, it will be appreciated that many other types of weave could be used.

5

The selection of one particular press pad over another depends largely on the type of pressing operation in which the pad is to be used. In all the given examples, the weft threads A each comprise a silicone covered stranded copper wire as is described above, which may be braided with stainless steel wire if appropriate for the application. The warp threads B preferably comprise one of stainless steel wires, copper wires, copper wires wrapped with an aromatic polyamide yarn in a conventional manner, aromatic polyamide yarn, or polyester yarn.

15

The weave cross-sections and the weave diagrams illustrating these examples are shown in a conventional manner. In the weave cross-sections comprising Figs. 1a to 3a, it is the weft which is shown in cross section with the warp interweaving therebetween. In the weave diagrams comprising Figs. 1b to 3b, the "vertical" lines represent the warp and the "horizontal" lines represent the weft; at each intersection between the warp and the weft a filled-in or crossed square indicates that the warp is placed above the weft whereas a blank square indicates that the weft is above the warp. In all cases, the weave diagrams show at least one round of weave.

20

25

30

Example 1

This weave is shown in Figs. 1a and 1b and comprises a single ply plain weave. The characteristics of this weave are as follows.

35

Number of warp threads per decimetre	45 to 65
Number of weft threads per decimetre	30 to 47
Weight of woven fabric (g/m ²)	2000 to 5000
Thickness of woven fabric (mm)	1.5 to 2.5

5

Examples 2 and 3

Single ply simple twill weaves are shown in Figs. 2a and 3a with their corresponding weave diagrams in Figs. 2b and 3b. Here, the warp strands pass over and under more than one weft strand at a time. In a 2/2 twill weave, as shown in Figs. 2a and 2b the warp threads *B* pass alternatively under and over two weft threads *A* and the woven fabric has the same amount of warp material on the both faces of the fabric, which thus presents the same appearance on both sides. Likewise, in a 3/3 twill weave, as shown in Figs. 3a and 3b the warp strands *B* pass alternatively under and over three weft strands *A*.

20

Twill weaves have the advantage of providing a highly flexible press cushion with a smoother surface than other weaves. This is advantageous in some applications.

25

The characteristics of both the 2/2 and 3/3 twill weaves are as follows.

Number of warp threads per decimetre	60 to 75
Number of weft threads per decimetre	30 to 55
Weight of woven fabric (g/m ²)	2000 to 5000
Thickness of woven fabric (mm)	2.0 to 3.0

30

CLAIMS

1. A press pad for use in a laminate press comprising a woven fabric of heat resistant strands, characterised in that a substantial proportion of at least one of the warp (B) and the weft (A) comprises a silicone elastomer.
2. A press pad as claimed in Claim 1, characterised in that the silicone elastomer has a specific gravity within the range of 1.1 g/cm³ to 1.4 g/cm³ inclusive.
3. A press pad as claimed in Claim 1 or Claim 2, characterised in that the silicone elastomer has a specific gravity of 1.20 ± 0.02 g/cm³.
4. A press pad as claimed in Claim 2 or Claim 3, characterised in that the silicone elastomer has a minimum tear strength of 15 kN per metre and a minimum tensile strength of 6MPa.
5. A press pad as claimed in any one of claims 1 to 4, characterised in that at least one of the warp (B) and the weft (A) comprises substantially solid silicone strands.
6. A press pad as claimed in any one of Claims 1 to 4, characterised in that at least one of the warp (B) and the weft (A) comprises silicone covered metal wire.
7. A press pad as claimed in Claim 6, characterised in that the wall thickness of the silicone of the silicone covered wire is at least 0.2 mm, and the overall outside diameter of the silicone covered wire is at least 1.0 mm.
8. A press pad as claimed in Claim 6 or Claim 7, characterised in that the metal wire comprises a stranded or braided copper wire wherein the diameter of each

wire strand is at least 0.05 mm.

5 9. A press pad as claimed in any one of Claims 6 to 8, characterised in that the metal wire comprises a stranded wire made up from at least 7 wire strands.

10 10. A press pad as claimed in any one of Claims 6 to 9, characterised in that the exterior of the silicone covered metal wire is covered by braided stainless steel wire.

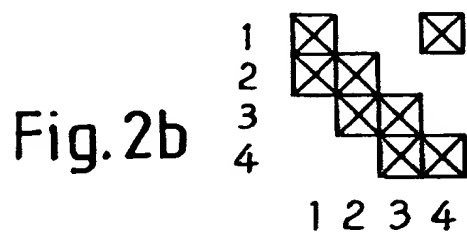
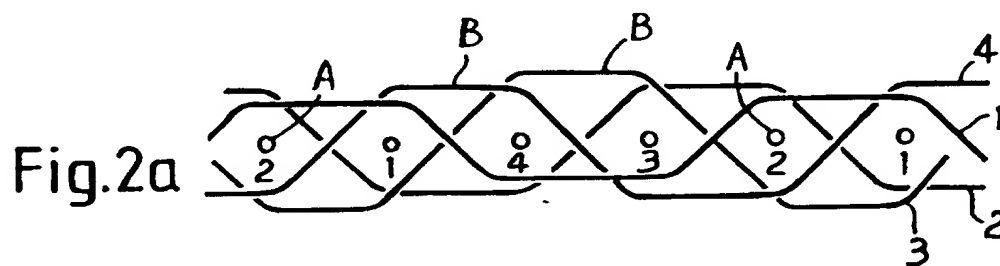
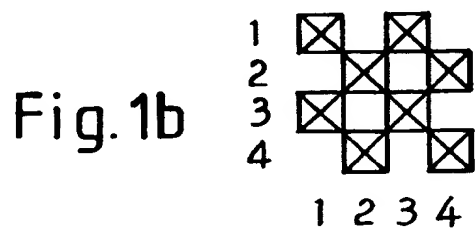
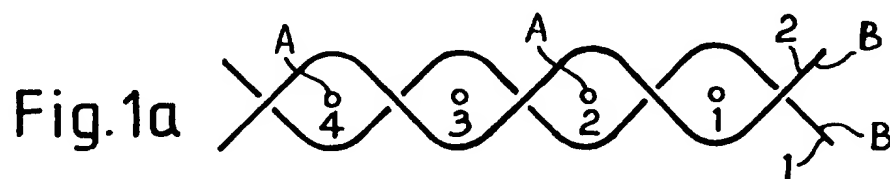
15 11. A press pad as claimed in any one of Claims 1 to 10, characterised in that the other of the warp (B) and the weft (A) from that which comprises the silicone elastomer, comprises strands of a copper alloy.

12. A press pad as claimed in Claim 11, characterised in that the copper alloy comprises an alloy of copper with at least one of cadmium, zirconium, and iron.

20 13. A press pad as claimed in any one of Claims 1 to 4, characterised in that the weft (A) comprises strands which comprise a silicone elastomer and in that the warp (B) comprises at least one of stainless steel wires, copper wires, copper alloy wires, copper wires wrapped with an aromatic polyamide yarn, stainless steel wires wrapped with an aromatic polyamide yarn, aromatic polyamide yarn, and polyester yarn.

30 14. A press pad as claimed in Claim 13, characterised in that the weft (A) comprises silicone covered copper wire.

1/2



2/2

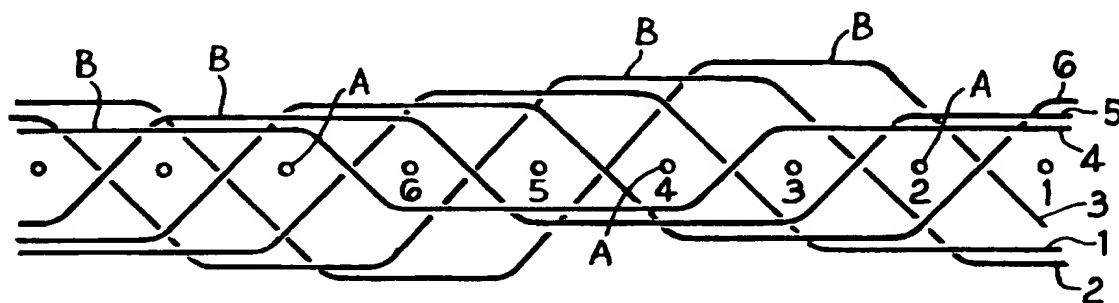


Fig. 3a

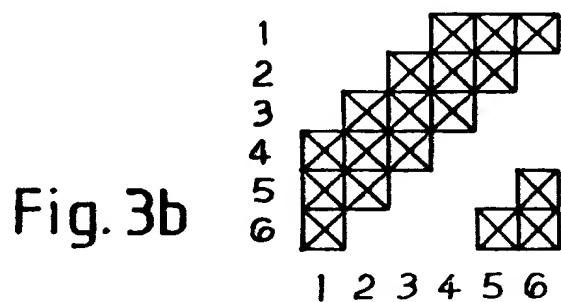
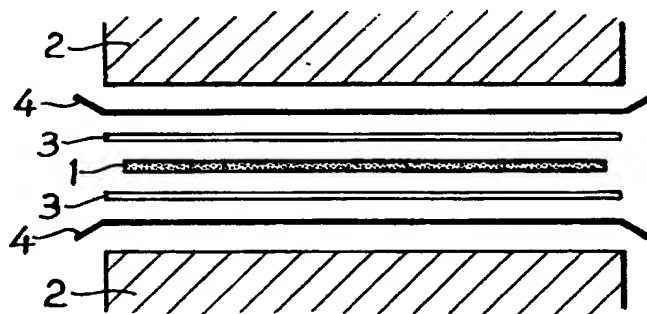


Fig. 3b

Fig. 4



INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 95/02421

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B30B15/06 D03D15/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B30B B32B D03D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	DE,U,94 18 984 (RHEINISCHE FILZTUCHFABRIK GMBH) 26 January 1995 see the whole document ---	1-14
X	PATENT ABSTRACTS OF JAPAN vol. 012 no. 105 (M-681) ,6 April 1988 & JP,A,62 234696 (MATSUSHITA ELECTRIC WORKS LTD) 14 October 1987, see abstract ---	1,5
X	PATENT ABSTRACTS OF JAPAN vol. 012 no. 105 (M-681) ,6 April 1988 & JP,A,62 234698 (MATSUSHITA ELECTRIC WORKS LTD) 14 October 1987, see abstract ---	1,5
-/--		

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"A" document member of the same patent family

Date of the actual completion of the international search

5 February 1996

Date of mailing of the international search report

14.02.96

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+ 31-70) 340-3016

Authorized officer

Voutsadopoulos, K

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 95/02421

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE,U,91 15 681 (RHEINISCHE FILZTUCHFABRIK GMBH) 20 February 1992 cited in the application see claims ---	1-14
A	FR,A,2 226 273 (BECKER & VAN HUELLEN) 15 November 1974 see claims; figures ---	1,13
A	DE,A,26 27 442 (BECKER & VAN HUELLEN) 29 December 1977 see claims; figures ---	1
A	DE,A,26 50 642 (VER SEIDENWEBEREIEN AG) 18 May 1978 see the whole document ---	1
A	EP,A,0 235 582 (HEWLETT PACKARD CO) 9 September 1987 see abstract; figure 3A -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 95/02421

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-U-9418984	26-01-95	NONE	
DE-U-9115681	20-02-92	EP-A- 0493630	08-07-92
		AT-T- 122963	15-06-95
		AU-B- 625929	16-07-92
		CA-A- 2043462	01-07-92
		DE-D- 59009157	29-06-95
		KR-B- 9502100	13-03-95
		US-A- 5298322	29-03-94
FR-A-2226273	15-11-74	DE-A- 2319593	14-11-74
		SE-B- 382175	19-01-76
		US-A- 3968296	06-07-76
DE-A-2627442	29-12-77	NONE	
DE-A-2650642	18-05-78	NONE	
EP-A-0235582	09-09-87	JP-A- 62208915	14-09-87

HPS Trailer Page
for

EAST

UserID: LSalvatore_Job_1_of_1

Printer: cp3_11c17_gbfkptr

Summary

<u>Document</u>	<u>Pages</u>	<u>Printed</u>	<u>Missed</u>	<u>Copies</u>
WO009613376	19	19	0	1
Total (1)	19	19	0	-